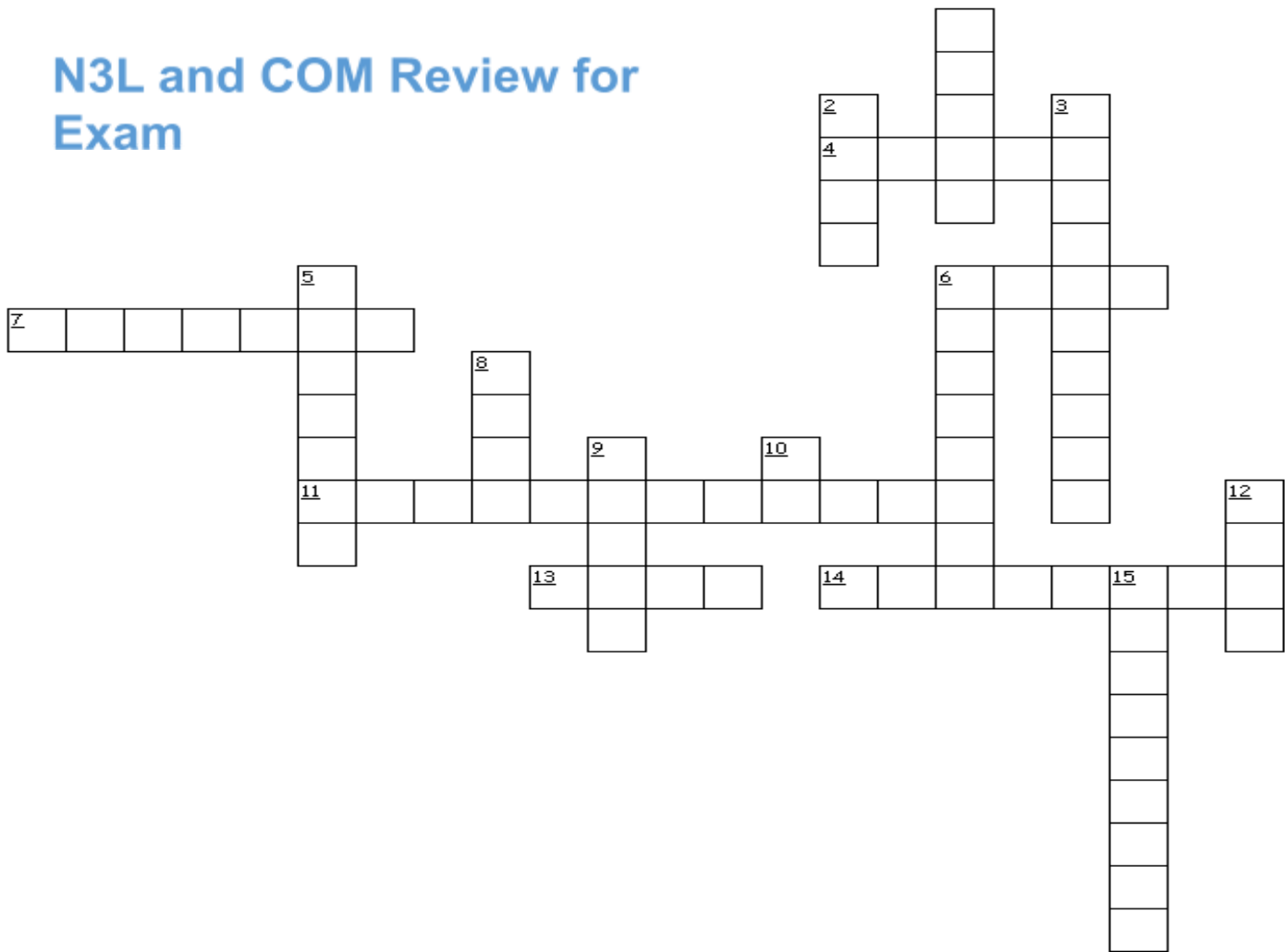


N3L and COM Review for Exam



Across

4. An archer shoots an arrow. Consider the action force to be the bowstring against the arrow. The reaction to this force is the arrow against bowstring.
6. A 5.0-kg ball has a momentum of 20.0 kg·m/s. What is the ball's speed? Four m/s
7. A table tennis ball launcher is fired. Compared to the force on the ball, the force on the launcher is the same force.
11. Whenever an object exerts a force on another object, the second object exerts a force of the same magnitude, but in the opposite direction to that of the first object.
13. A moving freight car runs into an identical car at rest on the track. The cars stick together. Compared to the velocity of the first car before the collision, the velocity of the combined cars after the collision is half
14. Momentum of a system is conserved only when the forces acting on it are internal to the system.

Down

1. Forces always occur in pairs.
2. A cannon recoils from launching a cannonball. The speed of the cannon's recoil is small because the mass of the cannon is large.
3. A karate expert executes a swift blow and splits a cement block with her bare hand exerting a force of 200 N on the block, what force was exerted on her hand? two hundred N.
5. The momentum change of an object is equal to the impulse on the object.
6. Suppose two people, one having two times the mass of the other, pull on opposite sides of a 12-foot rope while on frictionless ice. After a brief time, they meet. The more massive person slides a distance of four feet.
8. A piece of putty moving with 5 units of momentum strikes and sticks to a heavy bowling ball that is initially at rest. After the putty sticks to the ball, both are set in motion with a combined momentum that is five units.
9. If the momentum of an object changes and its mass remains constant, what had to change? The speed of the object.
10. A ball falls, the action force is the pull of Earth's mass on the ball. What is the reaction to this force? (oops, answer is the pull of the ball on the earth)
12. A piece of clay and a rubber ball have the same mass. If you drop them from the same height, which object will produce a greater impulse? The ball
15. Compared to a sports car moving at 30 miles per hour, the same sports car moving at 90 miles per hour has three times more momentum compared to the original speed.

Impulse $J = Ft$

Momentum $p = mv$

$$F\Delta t = m\Delta v$$

$$F = ma$$

$$a = (v_f - v_i) / t$$

$$F = m(v_f - v_i) / t$$

$p_{\text{before}} = p_{\text{after}}$ in elastic and inelastic collisions

Elastic Collision

$$m_{1b}v_{1b} + m_{2b}v_{2b} = m_{1a}v_{1a} + m_{2a}v_{2a}$$

$m_{1b}v_{1b}$ = momentum of mass 1 before the collision

$m_{1a}v_{1a}$ = momentum of mass 1 after the collision

$m_{2b}v_{2b}$ = momentum of mass 2 before the collision

$m_{2a}v_{2a}$ = momentum of mass 2 after the collision

Inelastic Collision

$$m_{1b}v_{1b} + m_{2b}v_{2b} = (m_{1a} + m_{2a})v_{2a}$$

$$(m_{1b} + m_{2b})v_{1b} = m_{1a}v_{1a} + m_{2a}v_{2a}$$

$m_{1b}v_{1b}$ = momentum of mass 1 before the collision

$(m_{1b} + m_{2b})v_{1b}$ = momentum of mass 1 and 2 before the collision

$m_{2b}v_{2b}$ = momentum of mass 2 before the collision

$m_{1a}v_{1a} + m_{2a}v_{2a}$ = momentum of mass 1 and 2 after collision

$(m_{1a} + m_{2a})v_{2a}$ = momentum of mass 1 and 2 after collision

A 20-kg cement block moving horizontally at 5 m/s plows into a bank of sand. If the block experiences a force of -40 N, how long will it take to come to a stop?

$$\Delta mv = Ft$$

$$(20)(-5) = -40t$$

$$t = -100 / -40 = 2.5 \text{ s}$$

A 40-kg football player leaps through the air to collide with and tackle a 50-kg player heading toward him, also in the air.

If the 40-kg player is heading to the right at 9 m/s and the 50-kg player is heading toward the left at 2 m/s, what is the speed and direction of the tangled players?

$$(40)(9) + (50)(-2) = 90v$$

$$260 = 90v$$

$$v = 260 / 90 = 2.9 \text{ m/s}$$

A 20-kg bowling ball moving at 4 m/s **bounces** (comes to a stop, then goes in the opposite direction) off a spring at about the same speed that it had before bouncing. What is the change in momentum of the bowling ball?

$$p = m\Delta v$$

$$p = (20)(-8)$$

$$p = -160 \text{ kg m/s}$$

A woman that weighs 50 kg jumps off the back of a boat **at rest** that weighs 300 kg. If she jumps off with a speed of 5 m/s in the **opposite direction** of the boat, how fast is the boat going after she jumps?

$$0 = (50)(-5) + (300)v$$

$$250 = 300v$$

$$v = 250 / 300 = 0.83 \text{ m/s}$$

Mr. H ignites the enthusiasm of the class with a home-made cannon demonstration. The 2.5-kg cannon is loaded with a 0.05-kilogram tennis ball and placed on the floor. Mr. H adds the fuel, waits for its vapors to fill the reaction chamber and then brings a match nearby. The explosion stuns the crowd and propels the ball forward and a photogate measurement determines that the ball moves with a speed of 200 m/s. Determine the speed of the **cannon**.

$$0 = (2.5)v + (.05)(200)$$

$$-10 = 2.5v$$

$$v = -10 / 2.5 = -4 \text{ m/s}$$

